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The Devastating Effect of Zeros on Grades: What Can Be Done?

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Abstract

The Devastating Effect of Zeros on Grades: What Can Be Done?

The effect of using zeros in grading students is reviewed, focusing on the inordinate weight given to zeros due to unequal intervals. Several approaches are suggested as practical solutions that balance the statistical properties inherent in averaging unequal grade intervals with the teacher's desire to use zeros for academic work. These include raising the floor for grades from zero to 60 or 65, use zeros only for a small portion of the grade or for borderline situations, ignoring zeros that deviate from other work, using the median rather than the mean, and allowing extra credit. A modest goal may be to help teachers clearly understand the effect of zeros on the average and on student effort and motivation.

The Devastating Effect of Zeros on Grades: What Can Be Done?

A particularly vexing problem in classroom assessment is how to handle zeros in determining final grades. The accepted practice for many teachers is to simply use the zero as one of many percentage scores that are averaged or added. Despite the admonitions of measurement specialists, this practice is widespread (Brookhart, 1993; Brookhart, 1994; Cross & Frary, 1996; Frary, Cross, Weber, 1993). For example, Brookhart (1993) reported that 42 of 84 K-12 teachers would assign a 0 for a project that was not completed, even if that meant that a student who averaged an A on quizzes and tests would obtain an F on the report card. Brookhart also reported that 86% of these same teachers would assign a zero for missing homework assignments, despite the fact that this would change the student's C-/D+ test average to an F for the grading period.

Why Using Zeros is Unfair

Why do teachers continue to practice such grading? Part of the answer appears to be related to valuing student effort as part of a final grade. Several researchers have indicated that teachers believe student effort should influence final grades (Brookhart, 1994; Frary, Cross, & Weber, 1993; Nava & Loyd, 1992; Stiggins & Conklin, 1992; Stiggins, Frisbie, & Griswold, 1989; Truog & Friedman, 1996), and completing work could be considered behavior that indicates effort or motivation. In a survey of 536 Virginia secondary teachers, 66 percent agreed or tended to agree that "exceptionally high or low effort should be recognized in the final grade" (Cross & Frary, 1996, p. 11). On the basis of a review of the literature on teachers' grading practices, Brookhart (1994) argues that effort is an important aspect of achievement, that it relates well to the notion that students need to earn grades, and that completing assignments is part of learning

responsibility. Consequently, students are penalized for not doing homework or failing to hand in projects with zeros, whereas often their positive efforts (or someone else's, like a parent) are rewarded with As for completion. At issue here is whether giving zeros and averaging them into a final grade is fair. Beyond the logical arguments about whether any assessments of effort should be included, there is a clear psychometric reason why indiscriminate averaging of zeros is unfair.

The devastating effect of zeros in determining grades is easy to illustrate with a few examples:

Lisa's homework, which counts 20% of the final grade, was not done correctly and she missed all the problems. She averages an 80% for the all the tests. Lisa's final grade, based on homework and tests, would average to a 64 (80 x .80 = 64; 0 x .20 = 0; 64 + 0 = 64).

John obtains a 90 on the midterm, which is 20% of the final grade, an 80 on the final exam, which is 40% of the final grade, and completes all his homework (100), which counts 10%. However he fails to hand in his project, which counts 30% toward the final grade, and receives a zero. His average is 60 (90 x .20 + 80 x .40 + 100 x .10 + 0 x .30 = 18 + 32 + 10 + 0 = 60).

Veronica forgets to bring her completed assignment to school and receives a zero. The assignment counts for 20% of her final grade. She has an average of 90 on all other completed work for the class (B), but ends up with a 72 (D).

In each case the student has paid a high price for missing all the problems or not handing in their work. What teachers need to understand is that assigning a zero may actually change the weight that they are giving to the work in determination of the final grade. That is, they may think they are weighting homework a certain percentage, but by giving a zero the resultant

weight may be much greater. When using percentage correct for grading, because the interval between 0 and whatever number is needed for a D is usually so large, picking the zero at one end of the interval gives it a disproportionately high weight. The result is that students are unfairly penalized. This is a classic case of how atypical extreme scores can skew the mean as a measure of central tendency. To keep the actual weight of each score the same, the interval between all the grades needs to be the same.

Some Practical Solutions

What can be done to avoid the deleterious and unfair use of zeros? There are several approaches that can be followed that balance the statistical properties inherent in averaging unequal grade intervals with the teacher's desire to use zeros for academic work (zeros should never be used for behavioral problems, tardiness, missing tests due to absence, and failure to return forms). Simply admonishing teachers to avoid using zeros in calculating grades is not consistent with the needs of many, if not most, teachers (Airasian & Jones, 1993; Brookhart, 1994). Each of the following approaches has advantages as well as limitations.

1. Use the bottom of the actual grading scale rather than zero. If the grading scale is A 94-100, B 87-93, C 80-86, and D 73-79, the "range" for F would be 66-72. Work not completed, or done incorrectly, would get a score of 66. Instead of having a 65-point spread between 0 and an F, with a 7 point spread between all other, the spread between "zero" and 65 also becomes 7 points (F = 58 - 65). If homework or some project is not handed in, it would be recorded as a 58, not as a 0, to reflect the same 7 point interval. This would keep the weight of the assignment consistent with the percentage that is supposed to be used in determining the final grade. Let's see how this plays out with some numbers.

Take John's scores from above and simply change the 0 to 58:

$$90 \times .20 + 80 \times .40 + 100 \times .10 + 58 \times .30 = 18 + 32 + 10 + 17.4 = 77.4$$

John would receive a 77.4 rather than a 60. This is the difference between John making an F and a C.

Another way to see the effect of a zero is to examine what happens when graded work is converted to numbers and then averaged for a final grade, or when rubrics are used. Suppose students are given grades for three projects and a paper. A scale or rubric is used to convert grades or levels of the rubric to numbers for calculating the final grade: A = 100, B= 90, C = 80, D = 70, F = 60. Each project and the paper is counted 25% in determining the final grade. If Sarah gets three Bs and a D her final score is 85 (90 x .25 + 90 x .25 + 90 x .25 + 70 x.25 = 85). If Sarah had received an F for the paper she had turned in, her final score would be 82.5. However, if she failed to hand in the paper and received a zero, her final score would be 67.5. Thus, the difference between using 60 or 0 in calculating the final score was 15 points, compared with only a 2.5 point difference when her paper grade changed from a D to an F. Using the zero has the effect of weighting the paper grade much more than what it weights when it is an A, B, C, D, or F. Thus, a potential solution to the zero dilemma is to grade all student work with letters, then convert the letters to grades, using an F for both uncompleted work as well as for work turned in when appropriate. It has the added advantage of being adaptable for rubrics.

This approach takes care of the measurement scale problem, but what would it do for student effort? If students know they will be given a 66 rather than a zero, will this mitigate motivation and make it more likely for students to miss assignments? On the other hand, what does getting a zero do for student effort? Do students who get a zero feel less able to obtain a good grade and henceforth exert little effort because of helplessness? Why should a student try hard once it is established that it will be next to impossible to raise the grade? The relationship between

motivation and assessment is one that has only recently been systematically addressed (Brookhart, 1994). While it seems clear that zeros act as extrinsic inducements to complete work, less is known about how zeros impact self-efficacy and intrinsic motivation. Also, it may be necessary to distinguish between refusal to do work and completing work that is incorrect. In both cases the numerical effect on a grade can be the same, even though the reasons for the zero are vastly different. This suggests that lack of effort should not be treated the same as exerting effort but being wrong.

2. Use zeros only for a very small percentage of the final grade. A different strategy is to keep zeros but use them only for assignments that count little toward the final grade. That is, if homework is 10% of the final grade and there are 10 homework assignments, each assignment counts only 1% of the final grade. A student would have to get many homework zeros to have an appreciable impact on the final grade. In this approach zeros would not be given for major assignments, such as papers and projects. Of course if students know the zeros will have a minimal influence on their final grade there may be the same motivational problem as using the bottom of the grading scale. If it won't make much difference, what is the incentive to do it?

3. Give effort a separate grade. Some schools use a system in which effort is graded separately from achievement. Indeed this practice has been encouraged (O'Connor, 1995). In this approach achievement grades include only indicators of student performance. If a student fails to complete an assignment the zero is used only for the "effort" grade. If only part of the assignment is completed, a grade can be given for achievement, even though it is incomplete, and an "effort" grade can likewise reflect partial completion. But how is degree of effort to be determined? Not handing in an assignment may be easy to judge; making decisions about partially completed work would be more subjective. In addition to the problem of how to judge student effort, there

can be confusion if student grades indicate high achievement and low effort (either the student is very bright or the assignments were not at the right level), or if grades indicate low achievement and high effort (either the student is not able to achieve or there is something wrong with the teacher). There is also the problem of what to do with major projects or papers that are not completed or only partially completed. How can achievement be judged without seeing the entire product? For these reasons, many schools report effort in an informal way that is not directly tied to grades, e.g., teacher comments about work habits. An even stiffer penalty that would surely gain the attention of students and parents is to give students an incomplete in any class in which assignments are not turned in. In this case effort is separate from achievement, but a reporting of achievement depends on adequate effort.

4. Use indicators of effort, including zeros, only for borderline grades. Most teachers understand that there is error in measurement. One way to take account of measurement error is to use an assessment of effort in cases where the scores are borderline. In this approach teachers could use the bottom of the grading scale for calculating final grades (see # 1), and keep a separate record of effort indicators, including zeros, to be used when the calculation of the final grade is borderline. The logic here is that lack of effort in general will be revealed in grades on assignments and tests, and that any additional emphasis on effort should be small. Students who complete the assignments would be given the higher grade, those who obtain zeros would be given the lower grade. In this approach, teachers would need to have some rules for obtaining a "score" for effort. For example, the teacher may tell students that zeros will be counted heavily in the "calculation" of effort for borderline grades. While it is relatively straightforward to use zeros as indicating lack of effort, 100 can indicate high effort but it isn't weighted to have an influence that is equal in impact but in an opposite direction as the zero.

5. Ignore zeros when they deviate from other indicators. Some teachers simply ignore zeros if a student has done exemplary work on other assignments and tests. While this is an option, it's rather difficult to consistently make judgments about which cases deserve such treatment and which don't, as well as how many zeros can be ignored. What constitutes exemplary work is subject to professional judgment? There are simply so many variables to think about in making the judgment that considerable subjectivity and bias are likely to be factors. If zeros are to be ignored at the end of the instructional segment, it needs to be done equally for all students. For example, the teacher can announce to the class that students can delete some number of grades; presumably students would take away any zeros. This may remove the zeros for most students but there is still the problem of motivation for those who thought relatively early on in the course that their zeros made it impossible to catch up.

6. Use the median rather than the mean. According to Wright (1994), teachers can avoid the unfair effect of using zeros if they calculate the median rather than the mean as the measure of central tendency. Teachers simply rank order the grades or scores and determine the midpoint. The argument is that since the data are typically ordinal (not interval), the median provides a more accurate average or typical score. However the use of the median does not work very well when different performances have different weights. Presumably different types of assignments and tests could be weighted by using the number of scores or grades on the single performance appropriately. If the final exam counts twice as much as the midterm, and the midterm twice as much as any quiz score, teachers would need to enter the midterm twice and the final exam four times for every quiz. That is, if a student obtained an A on the final, a B on the midterm, and three C's on quizzes, the final grade would be A (twelve As for the final, six Bs for the midterm, and three Cs for the quizzes). This would seem to be rather cumbersome for teachers, and even

more difficult to explain to students and parents. Furthermore, the teacher would need to be careful to make sure major tests and projects are weighed appropriate to the major role they play in demonstrating student achievement. This is, it would be easy for some teachers to take all of the grades achieved and rank order them all together, essentially giving each assignment or grade the same weight. Thus, while the detrimental effect of using zeros is avoided with this approach, other considerations argue against its use.

7. Allow extra credit to balance zeros. A final strategy is to incorporate some kind of assignment that students can complete to cancel out any zeros. This is similar to extra credit, except that the use is specific to zeros. This approach gives students the option of removing the negative effects of the zero, and teachers can encourage students as appropriate so that this will occur. The difficulty is that if students know that extra credit can remove zeros, why bother to hand in some assignments? This could have a cumulative negative effect on student learning. The extra credit, completed after the unit, becomes an external incentive to fix the grade.

Summary

The essential issue with giving zeros is whether it results in grades that are fair and accurate indicators of student performance. If there is an understanding that the final grade reflects more than what students know and are able to do, then teachers need to be open and explicit about how much other factors, such as effort and improvement, influence the grade. If zeros are used for missed assignments, then the teacher is essentially saying that lack of effort is penalized more than expected effort is rewarded. If teachers indicate that effort is not included in the grade, but still uses zeros, they need to understand better how the inclusion of the zeros does, in fact, add effort to the grade, sometimes weighing in as a significant determinant of the final grade.

Rightly or wrongly, the reality in schools is that most teachers use zeros for motivation and as indicators of lack of effort. As measurement specialists we can continue to advise against such practice, though on the basis of current practice, this approach has not worked too well in the past, or we can incorporate some less than perfect ideas so that teachers at least recognize the issues and address them with good information. A modest goal might be to help teachers understand the motivational dynamics in grading and how zeros affect motivation, the importance of effort in determining grades, and the psychometrics of averaging zeros to determine final grades (especially since computer software makes it so easy to average scores). If teachers grasp the issues and see the importance of being fair to students, hopefully they will modify current practice to be more consistent with what we know about how grading affects, as well as reflects, learning. These are fruitful areas for future research in classroom assessment and grading.

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